

More than ever, connectors make a better business case than hard-wiring

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Industrial connectors or hard-wiring? Often, the choice is portrayed as a conflict between past and present approaches for designing and building today's state of the art machines. For most OEMs, however, it's about the bottom line.

Benefits of connectors compel many to switch

Some OEMs believe, often wrongly, that connectors add to the up-front cost of their product. They tend to characterize their customers as so price-sensitive, they would choose the lowest possible sticker price over the lower total cost of ownership (TCO) offered by connectors over the service life of the machine. No matter that such a lower TCO can be substantial. Connectors will pay for themselves many times over through ease and speed of maintenance and by facilitating the renewal or upgrading of machines since sub-systems can be uncoupled and re-coupled in a fraction of the time it takes with hard-wired connections.

The benefits of connector-based wiring aren't just for the end user. There is a large and continually growing portfolio of OEMs that have found that switching to connectors has enabled them to increase their profits and reduce time to market. Converting to connector-based wiring can result in savings through more efficient design as well as a reduced workload in fabrication and installation. With today's modular and upgradeable machines, connectorization provides for easier integration and serviceability in the field.

Most industrial equipment contains extensive electrical wiring between components and subsystems. Connectors give engineers greater flexibility in machine design. At a minimum, they can optimize wire routing and space utilization within, even reduce the footprint of the machine. Connector-based wiring is almost perfectly complementary with the continuing shift to modular machine design. Modularization, where machines and plant systems are comprised of inter-related functional modules, offers significant efficiencies and economies over the traditional unitary design approach. Standard components such as control panels, motor assemblies and power distribution boxes can be pre-built and pre-tested, then plugged together in final assembly using connector-based wiring harnesses that are themselves pre-assembled and pre-tested. It's the next steps where connectors usually build up an unassailable cost advantage.



Today's modular connectors offer many benefits over hard-wired connections.



Modular connectors can be configured to carry power, signal and/or data in the same easy-to-install unit.

Connectorization means cost savings, flexibility

When a large machine is manufactured, it is typically assembled and tested at the plant, disassembled for shipping and reassembled at the job-site. With hardwiring, each connection – often there are hundreds – has to be individually unmade and remade as part of shipping and final setup, a significant additional cost. Connectors are plug and play; the same wiring can be unplugged and plugged in again for delivery/setup in a fraction of the time needed for hardwiring and with none of that extra labor cost. During field setup, it's also common for hardwiring errors to occur, delaying startup, even causing damage in extreme cases. With a connector-based wiring assembly, if it worked correctly at the plant, it will almost certainly work in the field from the get-go.

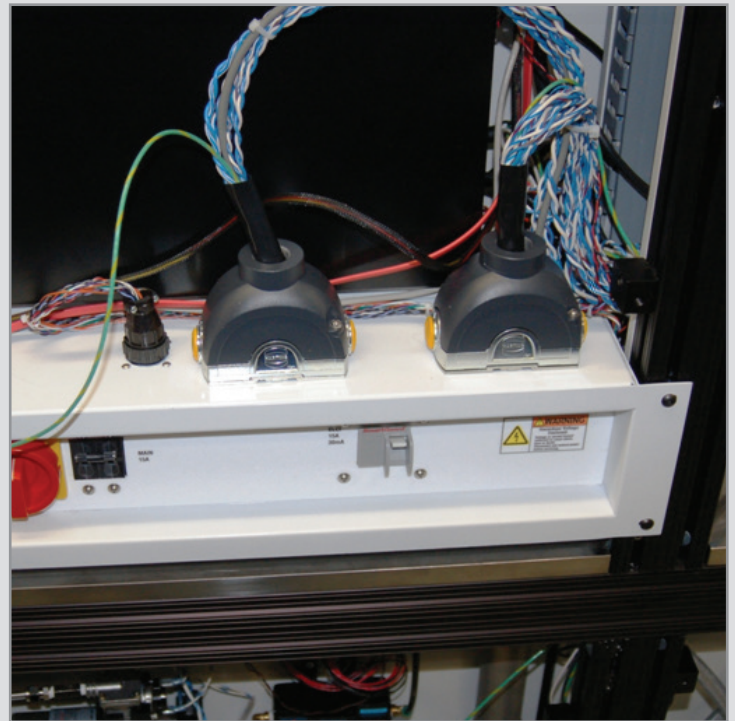
Even where the costs associated with connector-based wiring are greater during fabrication, the final installed cost usually is less than for hardwiring. Each machinery manufacturer has different labor and overhead costs, but a time study done by one OEM concluded that the fully burdened cost for hardwiring one pair of connection points in-house on a complex piece of equipment is about \$80. With connectors, there is typically a 40% labor cost premium, so using that same \$80 base cost and including \$60 for the two connectors implies that joining the same two points with connector-based wiring costs \$172. However, experience suggests there is a 30% premium on field-wiring labor costs versus those made at the plant. So when that same pair of hardwired connections is unmade and remade for shipping and/or installation of that same machine, the running total for hard-wiring reaches \$288 when that work is done at destination, even more if field-wiring errors are made, while the costs associated with connector-based wiring remain essentially unchanged. That represents cost savings using connectors in excess of \$100 – just for one pair of connections. (That's why it's said that a connector pays for itself the first time it is disconnected, whether for shipping, installation or for subsequent maintenance). The business rationale for hardwiring, at least from the machine builder's perspective, is competitive only where substantially all connections are made just once, at the factory.

Many OEMs echo what these North American companies found in switching to connectors:

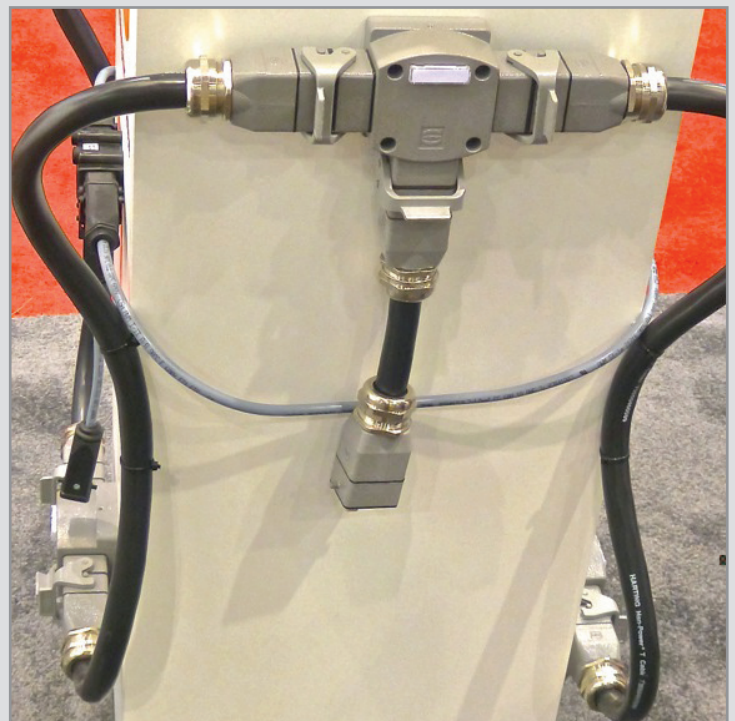
For these actual case studies of North American OEMs that switched to connectors, the financial benefits are measured not only as a direct cost saving, but also in increased production and, in some cases, a better product.

A company making paper conveyors for commercial printing presses had been hard-wiring over 200 wires to the control box of each unit prior to final testing. During a benchmarking process, it was determined the wiring process was taking up to four work days per unit. Switching to six modular connector assemblies in a plug-and-play solution reduced that to 2½ days. The new connector-based solution involved \$1,400 of additional hardware, but saved almost 2½ times that in labor and materials and helped accelerate production.

A manufacturer of large, automated precision-welding machines was making hundreds of hardwired connections per unit. It took a week to build and test one machine, then several days to dismantle it and another week to reassemble it at the customer. Switching to pluggable connectors cut wiring time dramatically; each step that used to take a full week is being done in less than a day.



Connecting cables to devices using connectors is a matter of plug and play



In a plant layout, connectors like HARTING's Han-Power® T distribute power and signal to motors as drops off a main cable.

A builder of conveyor systems for food and beverage production was designing an IP67-compliant product that could withstand harsh operating conditions like immersion in wash-down situations. It wanted to reduce install time and maintenance downtime as much as possible, and increase throughput by 15%. Switching to a state-of-the-art connector was key in accomplishing all these objectives.

A maker of acoustic microscopes for analyzing the integrity of semi-conductors developed a model requiring 120 hard-wired leads for powering processes, covering different voltages. The design objective was a machine with a small footprint, but engineers ran out of space inside the machine for such an elaborate wiring distribution. Using two heavy duty connectors with 60 pins each to optimize space utilization solved the problem, achieving all design objectives while capturing net material cost savings – no wiring bundles as well as less metal paneling throughout.

A commercial boat builder which upgraded its on-board electrical layout from hardwiring to modular connectors was able to cut the time for installing all cabin-to-hull wiring – over 300 connections – from two weeks to one day. The wire harnesses are pre-assembled off the boat. Connectors dispense with the need for 30 terminal strips spread throughout hull and allow the staff to better plan termination points.

Benefits of connectors extend to end users

For end users, connector-based wiring means planned or unplanned maintenance interruptions tend to be much shorter, a principal contributor to the lower TCO. Equipment is more reliable. When a failure does occur, it's easier to isolate the cause. If the problem is the connector, it can be repaired or replaced very quickly. In some cases, customers even do some of their own repairs without recourse to an electrician, saving time and money.

None of these benefits involves sacrificing quality. Today's connectors offer excellent mechanical stability and are available with high ingress, temperature and vibration resistance, harsh weather durability and multiple termination options. They come in many different sizes, are made in a range of coated and uncoated metals and plastics with different cable entry angles – to suit the available space and application requirements. For example, stainless steel connectors are widely used in hygienic environments like food, beverage or pharmaceutical production. Many models offer multiple termination options. Increasingly, connector manufacturers are developing products for applications with extreme demands. These special purpose connectors are based on standard designs and come in standard sizes, but are optimized for harsh weather, high heat, corrosive environments, high load applications or where high EMC or explosion protection is required.

Modularity lets users build custom connectors with standard parts

Even better, most rectangular connectors today are modular and user-configurable. Any OEM can create a custom connector ideally suited for the machine design or process out of standard catalogue parts. Using different inserts, each can be configured to carry combinations of different transmission media. These modules can integrate currents from a few milliamps to 200 A, voltages up to 5,000 V, pneumatic hosing, data lines, shielded bus signals, optical cables made of POF or glass fiber, and more. A single modular connector can be configured to for different DC voltages, and both AC and DC power. (The alternatives,

like mounting multiple terminal blocks inside a control cabinet, require additional labor and materials and take up more space).

New connector series are making it easier and faster than ever to create and install connector-based harnesses. For example, one new rectangular model only requires male crimp contacts. The electrical feed per wire can supply up to five contacts by using a multiplier insert in the connector, dispensing with the need for terminal blocks inside the machine. The housing can be populated from either side, so the entire connector interface – hood and housing – can be mounted from the outside once the machine is built. And this connector has an internal locking mechanism that works like a seat belt for fast, secure locking and push-button un-mating in seconds, for particularly fast field assembly.



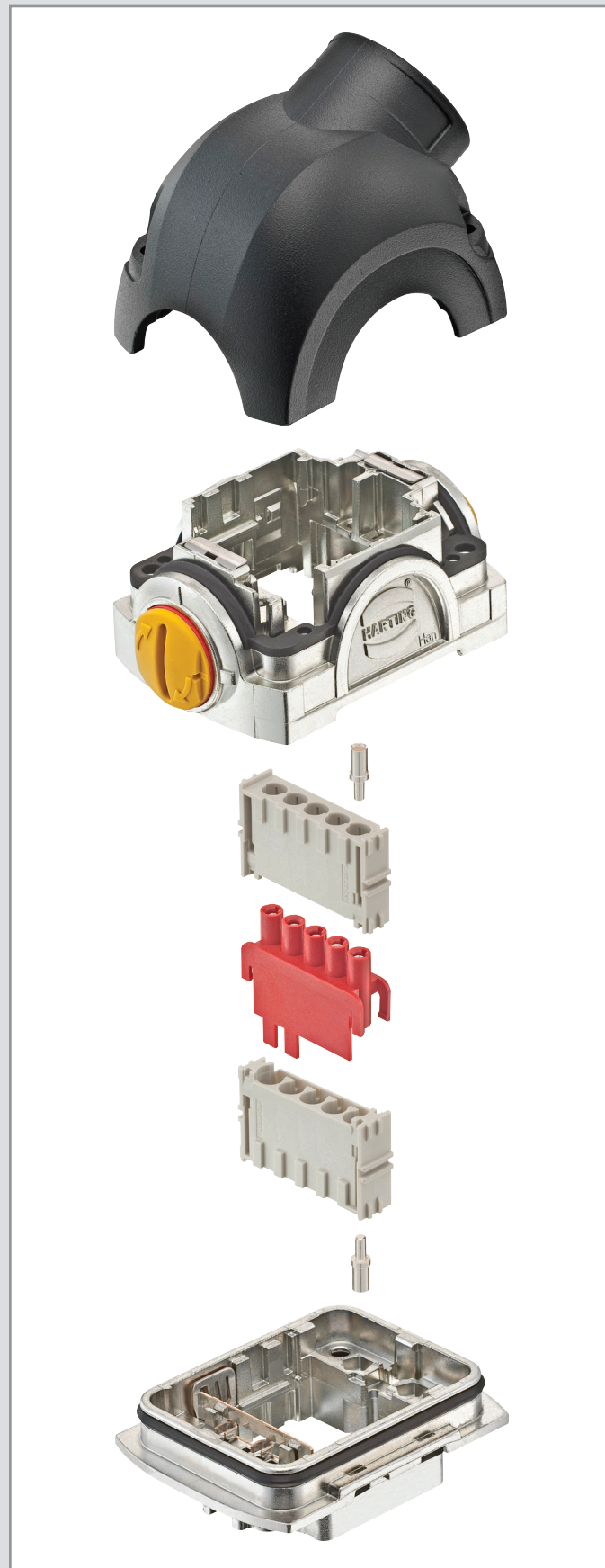
Field assembly time for devices and control cabinets is dramatically shortened using connectors instead of hard-wiring.



Connectors simplify design, assembly and maintenance for robots and other modular machinery.

HARTING leads the way

These and other innovations were developed by the HARTING Technology Group, building on the legacy of company founder Wilhelm Harting, who invented the rectangular industrial connector in 1950. The company, still owned and managed by his descendants and based in Espelkamp, Germany, is the global market share leader in heavy duty industrial connectors and a leader in all aspects of industrial and device connectivity. HARTING employs over 3,900 people at more than 40 subsidiaries and branch offices as well as production facilities in Europe, Asia and the United States. The HARTING brand is synonymous with helping make the industrial connector a staple of factory and process automation, transportation, logistics, solar and wind power generation and much more. HARTING created the age of user-configurable modularity with the launch of the Han-Modular® series in 1995, a concept so popular that almost all rectangular connectors sold today are modular. HARTING also has contributed new termination technologies like axial screw and Han-Quick Lock®. By re-investing over 6% of its global turnover in R&D, HARTING continues to produce a steady stream of new products like the award winning Han-Yellock® series that are making connectors more user-friendly and cost-effective than ever. As diverse as HARTING has become, the Hartings also prides themselves on running a business that remains focused on its customers, that listens to their needs and creates products and solutions that make them more competitive. 



User-defined modularity means creating a custom connector with standard components.